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(71)Applicant : CASIO COMPUT CO LTD
(72)Inventor : MURAKI ATSUSHI

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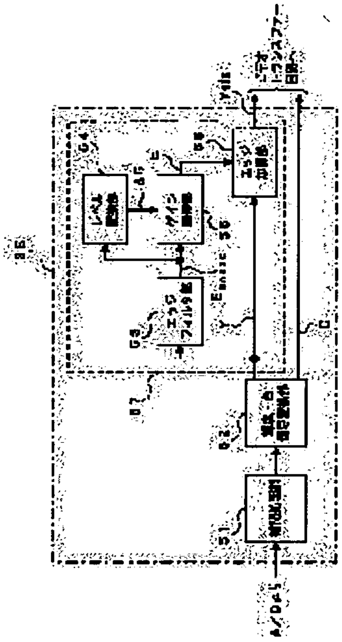
(54) EDGE ENHANCEMENT DEVICE, EDGE ENHANCEMENT METHOD AND RECORDING MEDIUM

(57)Abstract:



PROBLEM TO BE SOLVED: To provide an edge enhancement device that can adaptively correct various types of edges from steep edges to rather smooth edges.

SOLUTION: In the extraction of an edge part and correction of the pixel value of the edge part in its increasing direction to enhance the edge, an image correction processing section 57 generates a variable amplification factor (ΔG) changed corresponding to a pixel value (EBASIC) of the edge part and applies the amplification factor to the pixel value of the edge part to generate an edge enhancement correction value (E). The amplification factor (ΔG) has a characteristic of increasing the edge enhancement correction value (E) when the pixel value of the edge part resides in a large value area (an area where the EBASIC is large) more than when the pixel value of the edge part resides in a small value area (an area where the EBASIC is small).

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CLAIMS

[Claim]
[Claim 1] In the edge highlight equipment which extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the size of the pixel value of the aforementioned edge fraction is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction The aforementioned amplification coefficient is edge highlight equipment characterized by the direction when being in the field of a value bigger than the time of the pixel value of the aforementioned edge fraction being in the field of a small value having the property to which the aforementioned correction value for an edge highlight is made to increase.
[Claim 2] In the edge highlight equipment which extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction The aforementioned amplification coefficient is edge highlight equipment characterized by having the property of decreasing the aforementioned correction value for an edge highlight so that the aforementioned flatness becomes large.
[Claim 3] Edge highlight equipment of claim [which is characterized by having a 2-dimensional VCF for an extraction of the aforementioned edge fraction] 1, or claim 2 publication.
[Claim 4] An extraction means to extract the signal of the edge fraction in a picture signal, and a gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, Edge highlight equipment characterized by having a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment means according to the level of the signal of the edge fraction extracted by the aforementioned extraction means.
[Claim 5] The aforementioned change means is the edge highlight equipment of the claim 4 publication characterized by changing the degree of the aforementioned gain adjustment so that the variation of the level of the signal of the aforementioned edge fraction and the amount of change of the degree of the aforementioned gain adjustment may maintain a predetermined relation.
[Claim 6] The aforementioned change means is the edge highlight equipment of the claim 5 publication characterized by changing the degree of the aforementioned gain adjustment so that the relation predetermined [aforementioned] in the field where the level of the signal of the aforementioned edge fraction is low, and a high field may be changed.
[Claim 7] the claim 4 characterized by the aforementioned change means including a means to change the degree of the gain adjustment by the aforementioned gain-adjustment means so that the level of the signal of the edge fraction to which gain was adjusted by the aforementioned gain-adjustment means may be set to 0, when the level of the signal of the aforementioned edge fraction is below a predetermined value, or the claim 6 -- edge highlight equipment given in either
[Claim 8] the claim 4 characterized by the aforementioned change means including a means to fix the degree of the gain adjustment by the aforementioned gain-adjustment means when the level of the signal of the aforementioned edge fraction is beyond a predetermined value, or the claim 7 -- edge highlight equipment given in either
[Claim 9] An extraction means to extract the signal of the edge fraction in a picture signal, and a gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, An evaluation means by which the weighting coefficient of the central point evaluates the flatness of the aforementioned picture signal rather than a surrounding weighting coefficient using a parvus nxn piece flatness evaluation VCF, Edge highlight equipment characterized by having a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment

means according to the flatness of the picture signal evaluated by this evaluation means.
[Claim 10] The weighting coef[illegible]nt of the aforementioned central point is th[illegible]ge highlight equipment of the claim 9 publication characteriz[illegible]y being 0.
[Claim 11] In the edge highlight technique of extracting the edge fraction of a picture image, correcting the pixel value of the edge fraction in the increase orientation, and performing an edge highlight While the adjustable amplification coefficient which changes corresponding to the size of the pixel value of the aforementioned edge fraction is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction The aforementioned amplification coefficient is the edge highlight technique characterized by the direction when being in the field of a value bigger than the time of the pixel value of the aforementioned edge fraction being in the field of a small value having the property to which the aforementioned correction value for an edge highlight is made to increase.
[Claim 12] In the edge highlight technique of extracting the edge fraction of a picture image, correcting the pixel value of the edge fraction in the increase orientation, and performing an edge highlight While the adjustable amplification coefficient which changes corresponding to the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction The aforementioned amplification coefficient is the edge highlight technique characterized by having the property of decreasing the aforementioned correction value for an edge highlight so that the aforementioned flatness becomes large.
[Claim 13] Claim 11 ** characterized by performing an extraction of the aforementioned edge fraction using a 2-dimensional VCF is the edge highlight technique of claim 12 publication.
[Claim 14] In the record medium which stored the program which extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the size of the pixel value of the aforementioned edge fraction is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction The aforementioned amplification coefficient is the record medium which stored the program characterized by the direction when being in the field of a value bigger than the time of the pixel value of the aforementioned edge fraction being in the field of a small value having the property to which the aforementioned correction value for an edge highlight is made to increase.
[Claim 15] An extraction means to extract the signal of the edge fraction in a picture signal, and a gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, The record medium characterized by storing the program for realizing a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment means according to the level of the signal of the edge fraction extracted by the aforementioned extraction means.
[Claim 16] In the record medium which stored the program which extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction The aforementioned amplification coefficient is the record medium which stored the program characterized by having the property of decreasing the aforementioned correction value for an edge highlight so that the aforementioned flatness becomes large.
[Claim 17] An extraction means to extract the signal of the edge fraction in a picture signal, and a gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, An evaluation means by which the weighting coefficient of the central point evaluates the flatness of the aforementioned picture signal rather than a surrounding weighting coefficient using a parvus nxn piece flatness evaluation VCF, The record medium characterized by storing the program for realizing a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment means according to the flatness of the picture signal evaluated by this evaluation means.

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DETAILED DESCRIPTION

[Detailed description]
[0001]
[The technical field to which invention belongs] this invention relates to edge highlight equipment, the edge highlight technique, and a record medium. It is related with the picture image which uses the edge fraction of a digital image as a sharp (it is also called acute or a highlight), and improves a degradation of quality of image in detail, or has ******** at the edge highlight equipment which carries out manipulation correction, the edge highlight technique, and a record medium.
[0002]
[Prior art] One of the special effect (or quality-of-image improvement) technique of a digital image has an edge highlight. This gives the sharpness of appearance to quality of image by making conspicuous the profile (edge) fraction within a picture image. An edge fraction is a fraction which shows a rapid signal change within the 2-dimensional flat surface of a picture image. Quadratic-differential VCFs, such as primary differential VCFs, such as a-like 2-dimensional VCF, for example, ******** (Sobel), pre ******** (Prewitt), etc., or Laplacian (Laplacian), are used for an extraction of an edge fraction. Any VCF multiplies by the predetermined coefficient beforehand defined according to the position of each pixel to the value (pixel value) of the nxn piece (generally n= 3) pixel in which the principle contains an attention pixel, the "difference" is things, differential adds each multiplication result, and it is common in that the correction value for the edge highlight to the pixel value of an attention pixel is obtained. About the concrete calculation procedure of this correction value, it mentions later.
[0003] The edge highlight is used also as the inevitable quality-of-image improvement technique in the digital image generation equipment (henceforth an "electronic still camera") which used electronic image pickup devices, such as a digital camera, besides this, although it is one to a digital image of the arbitrary manipulation technique (what is performed arbitrarily [in order to give special effect and an effect of art]). With an electronic still camera, it is because picture image amendment processing by edge highlight is indispensable if it is in the electronic still camera of quality-of-image serious consideration especially, since the high region component of the spatial frequency of a digital image signal is easy to be lost and the sharpness of the edge fraction of a picture image is spoiled by the optical transfer function (the so-called OTF:Optical Transfer Function) of **** systems, such as a taking lens and an image pickup device, the band limit in the case of digital signal conversion and various signal processing, etc.
[0004] Drawing 9 (a) is the important section idea block diagram of the conventional electronic still camera containing the configuration for the above-mentioned picture image amendment processing. In this drawing, a photographic subject's 1 image is ****ed by the image pickup device 3 (generally CCD:Charge CoupledDevice) through the optical system 2, such as a taking lens, and is changed into picture signal A of an analog. After being changed into digital picture signal D by an analog / digital conversion circuit 4, picture signal A is the color processing circuit 5, and it is decomposed into the luminance signal (henceforth "rectified [edge highlight] luminance-signal Yedg") and chrominance-signal C by which the edge highlight was carried out, and it is taken out.
[0005] Drawing 9 (b) is the block diagram of the color processing circuit 5. The interpolation processing section 6 interpolated from the pixel value of the periphery pixel in quest of the pixel value with which the color processing circuit 5 was lost with the color filter of an image pickup device 3, The brightness and the chrominance-signal transform-processing section 7 which changes into luminance-signal Y and chrominance-signal C the picture signal by which pixel interpolation was carried out, The edge-detection section 8 and the edge adder unit 9 constitute the picture image amendment processing section 10 including the edge adder unit 9 which adds the edge-detection section 8 which takes out edge addition signal E from luminance-signal Y, and luminance-signal Y and edge addition signal E, and outputs rectified [edge highlight] luminance-signal Yedg.
[0006] Drawing 10 (a) is the block diagram of the picture image amendment processing section 10. The edge-filter section 11 among which the picture image amendment processing section 10 generates amendment basic signal (edge signal) EBASIC for the edge addition to an attention pixel using the Laplacian VCF etc. (extraction), The fixation which was able to define this amendment basic signal EBASIC beforehand amplification coefficient GSTATIC The gain-adjustment section 12 which doubles and outputs gain-adjustment finishing amendment

basic signal GEBASIC, It has the coring section 13 which sets to edge addition signal E gain-adjustment finishing amendment basic sig[illegible]EBASIC more than the threshold defined [illegible]ehand, and outputs it (it is an output as E= 0 in gain-adjustm[illegible]nishing amendment basic signal GEBASI[illegible] under threshold).

[0007] Here, the idea of the edge-filter section 11 of operation is explained, referring to drawing (drawing 3) of the below-mentioned example. In drawing 3 (a), eye 3x3 **s expresses the pixel respectively, and an attention pixel (object pixel of an edge highlight) and eight pixels of the periphery of central eye ** are reference pixels. The sign indicated in **** is the coefficient beforehand defined corresponding to each pixel position. On the design of a VCF, although the value of this coefficient can take any value, it should just fulfill the conditions that the aggregate value of all the coefficients of a reference pixel and the value of the coefficient of an attention pixel make the coefficient of the reference pixel (for example, vertical and horizontal pixel) with high functionality fundamentally larger than the coefficient of the other reference pixel to an attention pixel equally (or abbreviation equally). For example, if the coefficient of an attention pixel is set to KC and the coefficient of a reference pixel is set to KNW, KN, KNE, KE, KSE, KS, KSW, and KW one by one in the orientation of the circumference of a clock from a upper left, each enumerated data can be set up as follows.

KC = 1KNW =-1/12KN =-2/12KNE =-1/12KE =-2/12KSE =-1/12KS =-2/12KSW =-1 / 12kW =-2/12[0008] Now, two pixel arrays are considered. Drawing 10 (b) is the first example of a pixel array, and drawing 10 (c) is the second example of a pixel array. Two trains of a white level, a center, and the right are [the left single tier] black level, and, as for the first example of a pixel array, the lengthwise edge fraction is expressed. The second example of a pixel array expresses the non-edge fraction of whole surface black level. If the pixel value of a white level and black level is set to "0" and "1" for convenience, respectively, the pixel value of the first example of a pixel array will become like drawing 10 (d), and the pixel value of the second example of a pixel array will become like drawing 10 (e). The value of amendment basic signal EBASIC corresponding to the pixel value Ga of the attention pixel of drawing 10 (d) is following formula **, and the value of amendment basic signal EBASIC corresponding to the pixel value Gb of the attention pixel of drawing 10 (e) is calculated by following formula **.

EBASIC=(0xKNW) +(1xKN)+ (1xKNE)
+ (1xKE) +(1xKSE)+ (1xKS)
+ (0xKSW) +(0xKW)+(1xKC) **0.333 .... ** EBASIC=(1xKNW) +(1xKN)+ (1xKNE)
+ (1xKE) +(1xKSE)+ (1xKS)
+ (1xKSW) +(1xKW)+(1xKC) **0 .... ** [0009] The gain-adjustment section 10 multiplies by amplification coefficient GSTATIC of the fixation beforehand set to the value of these amendment basic signal EBASICs, and performs a gain adjustment. For example, in order to simplify an explanation, if GSTATIC=1, the value of gain-adjustment finishing amendment basic signal GEBASIC corresponding to the pixel value Ga will be set to "0.333", and the value of gain-adjustment finishing amendment basic signal GEBASIC corresponding to the pixel value Gb will be set to "0."

[0010] By the way, actual luminance-signal Y is formed into many gradation, and takes the dispersed value according to the luminosity. For example, in the case of 2m gradation, one of the values which divided between a white level and black level into 2m phase is taken. For this reason, even if it is a non-edge fraction, what will be been in the ideal status like drawing 10 (c) (a pixel value is distributed on the same gradation level) is very rare. Usually, since it is distributed with a minute level difference, if the value of gain-adjustment finishing amendment basic signal GEBASIC corresponding to the attention pixel Gb of a non-edge fraction is hardly set to "0" and it puts in another way, although it will become the minute value near "0" in many cases Since an edge highlight must not be performed with natural to the attention pixel Ga of a non-edge fraction, the circuit section (coring section 13) for limiting gain-adjustment finishing amendment basic signal GEBASIC with a minute value to "0" is prepared.

[0011] Drawing 11 is the input-output-behavioral-characteristics view of the coring section 13. In this drawing, x intercept (intersection with a quadrature axis) of the straight lines 14 and 15 whose inclinations are "1" is equivalent to the threshold of the coring section 13. In the example of illustration, "0.25" and since the threshold of the negative orientation is set as "-0.25", gain-adjustment finishing amendment basic signal GEBASIC is set to E= 0 by the threshold of the right orientation, when [of "-0.25" - "+0.25"] having fitted in the domain. Therefore, when gain-adjustment finishing amendment basic signal GEBASIC has the minute value of the above-mentioned domain, the gain-adjustment finishing amendment basic signal GEBASIC is limited to "0", and it can avoid performing unnecessary edge highlight processing.

[0012]

[Object of the Invention] However, in the above-mentioned picture image amendment processing section 10, since it had become the configuration which the fixation which was able to define beforehand amendment basic signal EBASIC taken out from the edge-filter section 11 doubles amplification coefficient GSTATIC, there were the following troubles.

[0013] (1) In order the edge generally contained in a picture image is various from the thing with ******** to the quiet thing and to obtain good quality of image Although the suitable highlight amendment according to the grade of these edges must be performed, if it is in the above-mentioned conventional technique Since amplification coefficient GSTATIC of the fixation defined beforehand was used, there was un-arranging in that the amplification property was [illegible]orm to amendment basic signal EBASIC a[illegible]as not able to give a suitable amplification property for every type of an edge. Namely, it becomes excessive to an edge quiet when amplification coefficient GSTATIC is fitted to the edge with ******** and set up. In conversely, when a quiet edge is made to suit and it sets up, as a result of becoming [too little] to the edge with ********, at the sacrifice of any or one side in practice or both compromise -- amplification coefficient GSTATIC -- not setting up -- it did not obtain, but the edge various type was rectified in adaptation (highlight), and there was a problem which should be improved in that good quality of image cannot be obtained

[0014] (2) Moreover, for example, consider a pixel distribution of 3x3 configuration which sets the pixel value of "1" and its circumference pixel to "0" for the pixel value of an attention pixel (see the conceptual diagram at the left end of drawing 8). This is the pixel distribution containing the so-called isolated-point noise in which a central pixel is isolated from the periphery. The value of amendment basic signal EBASIC applied to the pixel value of the attention pixel in this case is calculated by following formula **.

EBASIC=(0xKNW) +(0xKN)+ (0xKNE)
+ (0xKE) +(0xKSE)+ (0xKS)
+ +(0xKW)+(1xKC) =1 (0xKSW) .... In spite of being a non-edge fraction since it is set to GEBASIC=1 and GEBASIC exceeds the threshold (0.25) of the coring section 13 when **, therefore GSTATIC=1 As a result of becoming E=GEBASIC-threshold (namely, E= 0.75) and performing unnecessary addition processing (this example 0.75+Y) by the edge adder unit 9, there is a trouble of emphasizing an isolated-point noise (pixel value which is an attention pixel), and highlighting it on the contrary.

[0015] The 1st technical probrem which this invention tends to solve is to offer the edge highlight equipment which can rectify the edge various type from the edge with ******** to a quiet edge in adaptation. Moreover, the 2nd technical probrem is to offer the edge highlight equipment, the edge highlight technique, and the record medium which can moreover rectify the edge various type from the edge with ******** to a quiet edge in adaptation, without highlighting an isolated-point noise.

[0016]

[The means for solving a technical problem] The edge highlight equipment concerning invention of claim 1 publication In the edge highlight equipment which extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the size of the pixel value of the aforementioned edge fraction is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction As for the aforementioned amplification coefficient, the direction when being in the field of a value bigger than the time of the pixel value of the aforementioned edge fraction being in the field of a small value is characterized by having the property to which the aforementioned correction value for an edge highlight is made to increase. The edge highlight equipment concerning invention of claim 2 publication In the edge highlight equipment which extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction It is characterized by the aforementioned amplification coefficient having the property of decreasing the aforementioned correction value for an edge highlight so that the aforementioned flatness becomes large. Edge highlight equipment concerning invention of claim 3 publication is characterized by having a 2-dimensional VCF for an extraction of the aforementioned edge fraction in invention of claim 1 or claim 2 publication. The edge highlight equipment concerning invention of claim 4 publication An extraction means to extract the signal of the edge fraction in a picture signal, and a gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, It is characterized by having a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment means according to the level of the signal of the edge fraction extracted by the aforementioned extraction means. The edge highlight equipment concerning invention of claim 5 publication is set to invention of claim 4 publication, and the aforementioned change means is characterized by changing the degree of the aforementioned gain adjustment so that the variation of the level of the signal of the aforementioned edge fraction and the amount of change of the degree of the aforementioned gain adjustment may maintain a predetermined relation. The aforementioned change means is characterized by changing the degree of the aforementioned gain adjustment so that the edge highlight equipment concerning invention of claim 6 publication may change the relation predetermined [aforementioned] in the field where the level of the signal of the aforementioned edge fraction is low, and a high field in invention of claim 5 publication. the edge highlight equipment concerning invention of claim 7 publication -- the claim 4 or the claim 6 -- in invention given in either, it is characterized by for the aforementioned change means to include a means change the degree of the gain adjustment by the aforementioned gain-adjustment means so that the level of the signal of the edge fraction to which gain was adjusted by the aforementioned gain-adjustment means may be set to 0, when the level of the signal of the af[illegible]entioned edge fraction is below a predeter[illegible]d value the edge highlight equipment concerning inventio[illegible] claim 8 publication -- the claim 4 or the cl[illegible]7 -- in invention given in either, it is characterized by the aforementioned change means including a means to fix the degree of the gain adjustment by the aforementioned gain-adjustment means, when the level of the signal of the aforementioned edge fraction is beyond a predetermined value The edge highlight equipment concerning invention of claim 9 publication An extraction means to extract the signal of the edge fraction in a picture signal, and a gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, An evaluation means by which the weighting coefficient of the central point evaluates the flatness of the aforementioned picture signal rather than a surrounding weighting coefficient using a parvus nxn piece flatness evaluation VCF, It is characterized by having a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment means according to the flatness of the picture signal evaluated by this evaluation means. In invention of claim 9 publication, as for the edge highlight equipment concerning invention of claim 10 publication, the weighting coefficient of the aforementioned central point is characterized by being 0. The edge highlight technique concerning invention of claim 11 publication In the edge highlight technique of extracting the edge fraction of a picture image, correcting the pixel value of the edge fraction in the increase orientation, and performing an edge highlight While the adjustable amplification coefficient which changes corresponding to the size of the pixel value of the aforementioned edge fraction is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction As for the aforementioned amplification coefficient, the direction when being in the field of a value bigger than the time of the pixel value of the aforementioned edge fraction being in the field of a small value is characterized by having the property to which the aforementioned correction value for an edge highlight is made to increase. The edge highlight technique concerning invention of claim 12 publication In the edge highlight technique of extracting the edge fraction of a picture image, correcting the pixel value of the edge fraction in the increase orientation, and performing an edge highlight While the adjustable amplification coefficient which changes corresponding to the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction It is characterized by the aforementioned amplification coefficient having the property of decreasing the aforementioned correction value for an edge highlight so that the aforementioned flatness becomes large. The edge highlight technique concerning invention of claim 13 publication is characterized by claim 11 ** performing an extraction of the aforementioned edge fraction in invention of claim 12 publication using a 2-dimensional VCF. The edge fraction of a picture image is extracted, the adjustable amplification coefficient which changes corresponding to the size of the pixel value of the aforementioned edge fraction is generated in the record medium which stored the program which corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight, and the record medium concerning invention of claim 14 publication is the aforementioned **** about this amplification coefficient. While it applies to the pixel value of a ** fraction and the correction value for an edge highlight is generated, as for the aforementioned amplification coefficient, the direction when being in the field of a value bigger than the time of the pixel value of the aforementioned edge fraction being in the field of a small value is characterized by having the property to which the aforementioned correction value for an edge highlight is made to increase. An extraction means by which the record medium concerning invention of claim 15 publication extracts the signal of the edge fraction in a picture signal, A gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, It is characterized by storing the program for realizing a change means to change the degree of the gain adjustment by the aforementioned gain-adjustment means according to the level of the signal of the edge fraction extracted by the aforementioned extraction means. In the record medium which stored the program which the record medium concerning invention of claim 16 publication extracts the edge fraction of a picture image, corrects the pixel value of the edge fraction in the increase orientation, and performs an edge highlight While the adjustable amplification coefficient which changes corresponding to the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is generated and the correction value for an edge highlight is generated with the application of this amplification coefficient to the pixel value of the aforementioned edge fraction It is characterized by the aforementioned amplification coefficient having the property of decreasing the aforementioned correction value for an edge highlight so that the aforementioned flatness becomes large. An extraction means by which the record medium concerning invention of claim 17 publication extracts the signal of the edge fraction in a picture signal, A gain-adjustment means to adjust the gain of the signal of the edge fraction extracted by this extraction means, An edge highlight means to emphasize the edge fraction in the aforementioned picture signal using the signal of the edge fraction to which gain was adjusted by this gain-adjustment means, An evaluation means by which the weighting coefficient of the central point evaluates the flatness of the aforementioned picture signal rather than a surrounding weighting coefficient using a parvus nxn piece flatne[illegible]aluation VCF, It is characterized by storin[illegible] program for realizing a change means to change the de[illegible] of the gain adjustment by the aforementio[illegible]gain-adjustment means according to the flatness of the picture signal evaluated by this evaluation means.

[0017]

[Gestalt of implementation of invention] Hereafter, an electronic still camera is made into an example for the gestalt of enforcement of this invention, and it explains, referring to a drawing. In addition, an application of this invention is not limited to the following electronic still cameras. It is [that what is necessary is just the equipment or the process of dealing with a digital image] applicable to various equipments, such as an image scanner, facsimile, a printer, a digital video camera, and a digital image edit machine. Or it is applicable to the application program software containing the process for realizing a function equivalent to these equipments on hardware, such as a personal computer.

[0018] Drawing 1 is the block diagram of an electronic still camera. The electronic still camera of illustration from the function The picture image product 20 and picture signal which generate a photographic subject's picture signal are saved temporarily. To regeneration, other manipulation processings, etc., facilities Temporarily to plan the store storage system 21 and a capture picture image Compression / extension processor 24 which carries out compression processing of the picture signal in case it saves in the long-term store storage system 22 saved over a long period of time, the image display system 23 which displays the composition authentication at the time of photography, and a regeneration picture image, and the long-term store storage system 22, or carries out extension processing of the picture signal read from the long-term store storage system 22, It can divide into the control system 25, the data transfer system 26, etc. which control the whole operation of an electronic still camera. Hereafter, a configuration is explained for every system.

[0019] The picture image product 20 ****s a photographic subject image by the image pickup device, changes it into an electrical signal, and generates and outputs the picture signal (it is also called a frame picture signal) of a predetermined period from this electrical signal. Although the picture signal of the color is generated with the gestalt of this enforcement, you may be the picture signal of monochrome. The picture image product 20 The light from the photographic subject which passed a photographic lens, the optical system 29 which extracts and includes a device, and the optical system 29 is changed into an electrical signal. The frame picture signal of a predetermined period Image pickup devices, such as CCD to output (It represents with "CCD" below) 30 and CCD30 The timing generator 32 which generates various timing signals, such as a signal which controls the driver 31 for driving and the imaging time (electronic shutter time) of CCD30, and the frame picture signal outputted from CCD30 are sampled (for example, correlation double sampling). The sample hold circuit 33 which removes a noise, and the analog-to-digital converter 34 which changes the frame picture signal after a rejection into a digital signal are included. Furthermore, the color process circuit 35 which generates the brightness and color difference composite signal (it may be called "YUV signal" below) which consists of luminance-signal Y and chrominance-signal C using the output from an analog-to-digital converter 34 is included. This color process circuit 35 is equipped with the picture image amendment processing section (the picture image amendment processing section 57; detail of drawing 2 is mentioned later) for compensating the high region component in the picture signal lost by internal processing of preceding paragraph circuits, such as optical system 29 and CCD30, and the color process circuit 35 etc.

[0020] This buffer memory 37 is equipped with the buffer field of sufficient size (storage capacity) which can develop the picture signal incorporated from the long-term store storage system 22 at least through the picture signal or the data transfer system 26 incorporated from the picture image product 20 through the data transfer system 26 including the buffer memory 37 of the predetermined storage capacity which consisted of a storage (for example, semiconductor memory, such as DRAM and SRAM) which the store storage system 21 can rewrite temporarily. The long-term store storage system 22 consists of a rewritable nonvolatile storage 39, for example, a flash memory, and this flash memory 39 has some dozens or a capacity memorizable several 100 times for the image file of the predetermined format by which compression processing was carried out by compression / extension processor 24. In addition, the flash memory 39 may be the configuration (for example, card type) which can be removed.

[0021] The image display system 23 is what carries out a regeneration display (the so-called through image display) for composition authentication of the picture signal outputted a predetermined period from the picture image product 20, or carries out the regeneration display of the picture image [finishing / the record to a flash memory 39]. The size of a regeneration picture image The touch panel 44 which detects the touch coordinate on the display screen of the liquid crystal display 43 of the color which displays on a screen the output from the digital video encoder 42 changed into a display size, and the digital video encoder 42, and the liquid crystal display 43, The touch panels I/F (interface)45 which change the output signal of a touch panel 44 into a predetermined format, and are outputted to a control system 25 are included. Compression / extension processor 24 carries out extension processing of the compression image file which carries out compression processing of the picture signal saved at buffer memory 37 by predetermined format (for example, JPEG:joint photographic experts group), and was saved at the flash memory 39 by this format. A control system 25 answers operation of the various keys including CPU40 and the shutter key which perform a predetermined control program and control the whole operation of [illegible]ectronic still camera, generates a necessar[illegible] stroke signal, and contains the key input section 41 which outp[illegible]the key stroke signal to CPU40. The data t[illegible]sfer system 26 contains the video transfer circuit 36 which arbitrates the data flow between each **, and the bus (general term of a data bus, an address bus, and a control line) 45 which connects between each **.

[0022] Drawing 2 is the block diagram of the color process circuit 35. The interpolation processing section 51 interpolated from the pixel value of the periphery pixel in quest of the pixel value with which the color process circuit 35 was lost with the color filter of CCD30, The brightness and the chrominance-signal transform-processing section 52 which changes into luminance-signal Y (signal with a luminosity information), and chrominance-signal C (signal; with a **** information generally color-difference signal) the picture signal by which pixel interpolation was carried out, The edge-filter section 53 (equivalent to a 2-dimensional VCF given in the summary of invention, and an extraction means) which generates amendment basic signal EBASIC corresponding to an attention pixel using the Laplacian VCF etc., The level-conversion section 54 which generates adjustable amplification coefficient deltaG based on this amendment basic signal EBASIC, Amendment basic signal EBASIC deltaG The gain-adjustment section 55 which doubles and carries out a gain adjustment (EBASIC after a gain adjustment is set to E), The edge adder unit 56 which adds edge addition signal E (equivalent to the correction value for an edge highlight given in the summary of invention) and luminance-signal Y, and takes out rectified [edge highlight] luminance-signal Yedg is included. The edge-filter section 53, the level-conversion section 54, the gain-adjustment section 55, and the edge adder unit 56 constitute the picture image amendment processing section 57 (equivalent to edge highlight equipment given in the summary of invention, a gain-adjustment means, and a change means) as one.

[0023] Drawing 3 (a) is the VCF conceptual diagram of the edge-filter section 53. In this drawing, eye 3x3 **s shown for convenience expresses the pixel respectively, and an attention pixel (object pixel of an edge highlight) and eight pixels of the periphery of central eye ** are reference pixels. The sign indicated in ** inside as the beginning explained (it KNWs, KNs and KNEs) KE, KSE, KS, KSW, KW, and KC are the coefficients (filter factor) beforehand defined corresponding to each pixel position. the value of this coefficient It is arbitration as long as the conditions that the aggregate value of all the coefficients of a reference pixel and the value of the coefficient of an attention pixel make the coefficient of the circumference pixel (for example, vertical and horizontal pixel) with high functionality larger than the coefficient of the other circumference pixel to an attention pixel equally (or abbreviation equally) are fulfilled.

[0024] Drawing 3 (b) is drawing showing an example of a filter factor. That is, it is the example which set to "-2/12" the coefficient whose functionality is four pixels of high four directions to the attention pixel, and set to "-1/12" the coefficient whose functionality is the pixel of low four corners. the coefficient of an attention pixel -- "1" -- it is -- coefficient total value of eight reference pixels (-2/12) x4+(-1/12) x4=1.0 .... since it is ** -- both value -- about -- I do one and the above-mentioned conditions are fulfilled The edge-filter section 53 incorporates luminance-signal Y outputted from brightness and the chrominance-signal transducer 52, and generates amendment basic signal EBASIC to the attention pixel of luminance-signal Y with the application of the filter factor of drawing 3 (b) every 3x3 pixels of the luminance-signal Y. For example, when a distribution of luminance-signal Y is made into the first above-mentioned example (refer to drawing 10 (b) and drawing 10 (d)) of a pixel array, amendment basic signal EBASIC becomes abbreviation "0.333" from front formula **. Or when a distribution of luminance-signal Y is made into the second above-mentioned example (refer to drawing 10 (c) and drawing 10 (e)) of a pixel array, amendment basic signal EBASIC becomes abbreviation "0" from front formula **.

[0025] The level-conversion section 54 generates amplification coefficient deltaG which changes corresponding to the size of amendment basic signal EBASIC. Drawing 4 (a) is the correlation diagram showing the correspondence relation between amendment basic signal EBASIC and amplification coefficient deltaG. An axis of ordinate expresses the size of amplification coefficient deltaG, and the quadrature axis expresses the size of amendment basic signal EBASIC. The size of amplification coefficient deltaG at the arbitration time is drawn from the intersection of the size of amendment basic signal EBASIC at that time, and the ultimate liness 61a and 61b. For example, in the example of illustration, at the time of EBASIC=0.5, it is set to deltaG=0.333, and at the time of EBASIC=0.75, it is set to deltaG=0.667 and set to deltaG=1.0 at the time of EBASIC=1.0. However, in a positive field, x intercept (intersection with a quadrature axis) of ultimate liness 61a and 61b is -SL in SL and a negative field, for example, are SL=0.25 and -SL=-0.25. Therefore, when the size of amendment basic signal EBASIC is settled within the limits of SL - -SL, deltaG is limited to "0."

[0026] Drawing 4 (b) is the correlation diagram showing the correspondence relation between amendment basic signal EBASIC and edge addition signal E. An axis of ordinate expresses the size of edge addition signal E, and the quadrature axis expresses the size of amendment basic signal EBASIC. The size of edge addition signal E at the arbitration time is drawn from the intersection of the size of amendment basic signal EBASIC at that time, and the ultimate liness 62a and 62b. For example, in the example of illustration, at the time of EBASIC=0.5, it is set to 0.5xdeltaG(0.5) =0.167, and at the time of EBASIC=0.75, it is set to 0.75xdeltaG(0.75) =0.5 and is set to 1.0xdeltaG(1.0) =1.0 at the time of EBASIC=1.0. deltaG (0.5) is the size (0.333) of deltaG at the time of

EBASIC=0.5 in drawing 4 (a) here, deltaG (0.75) is the size (0.667) of deltaG at the time of EBASIC=0.75 in this drawing, and deltaG (1.0) i[illegible] size (1.0) of deltaG at the time of EBASI[illegible]0 in this drawing. Three positions (P 0.5, P0.75 and P1.0[illegible]own on ultimate-lines 62a express the inte[illegible]ion with amendment basic signal EBASIC at the time of E= 0.167, E= 0.5, and E= 1.0, respectively, and ultimate-lines 62a can be said "It has the change inclination which increases so exponentially that amendment basic signal EBASIC becomes large" from these intersections. In addition, this inclination is the same also about ultimate-lines 62b in the negative field only in polarities only differing. A position P0.5 is equivalent to "the field of a small value" given in the summary of invention, and P0.75 and P1.0 are equivalent to "the field of a big value" given in this summary.

[0027] The inclination of the ultimate liness 62a and 62b that edge addition signal E increases exponentially so that the above-mentioned change inclination, i.e., amendment basic signal EBASIC, becomes large is the important point which cannot be lacked, in order to attain the 1st technical probrem (enable it to rectify the edge various type from the edge with ******** to a quiet edge in adaptation) of this invention. It is because a weaker edge amendment is performed by this small edge addition signal E since amendment basic signal EBASIC becomes small [edge addition signal E] small therefore in a quiet edge fraction to a stronger edge amendment being performed by this big edge addition signal E since amendment basic signal EBASIC becomes large [edge addition signal E] greatly therefore in the edge fraction with ********.

[0028] The electronic still camera of the gestalt of this enforcement carries out digital conversion of S/H33 by A/D34 through the picture signal which ****ed by CCD30. While the picture signal by which digital conversion was carried out is incorporated in the color process circuit 35 and luminance-signal Y and chrominance-signal C are generated from a picture signal in this color process circuit 35 Take out an edge component (amendment basic signal EBASIC) out of luminance-signal Y, and edge addition signal E corresponding to the size of the edge component is added to luminance-signal Y. Necessary carries out an edge highlight amendment (compensate the high region component lost by OFTs, such as optical system 29 and CCD30, and various band limits, and correct a degradation of a picture image). The luminance signal (rectified luminance-signal Yedg) and chrominance-signal C after an amendment are written in buffer memory 37 through the video transfer circuit 36, and it displays on a liquid crystal display 43 as a through picture image, or keeps on record to a flash memory 39.

[0029] Here, the 1st technical probrem of this invention is in the thing "which can rectify the edge various type from the edge with ******** to a quiet edge in adaptation" and which is made like. The gestalt of the above-mentioned implementation can solve this technical probrem. Amplification coefficient GSTATIC of the aforementioned conventional example concerns and was uniform for the size of amendment basic signal EBASIC. Now, EBASIC=0.5, EBASIC=0.75, and three examples of EBASIC=1.0 are considered. If amplification coefficient GSTATIC of the conventional example is set to "1" for convenience, since edge addition signal E in the conventional example is given with "the threshold of the E=EBASICxGSTATIC-coring section 13", each of the three above-mentioned examples will be set to E= 0.25, E= 0.5, and E= 0.75. That is, rectified luminance-signal Yedg at the time of EBASIC=0.5 is set to "Yedg=Y+0.25", rectified luminance-signal Yedg at the time of EBASIC=0.75 is set to "Yedg=Y+0.5", and rectified luminance-signal Yedg at the time of EBASIC=1.0 is set to "Yedg=Y+0.75."

[0030] On the other hand, amplification coefficient deltaG in the gestalt of this enforcement changes corresponding to the size of amendment basic signal EBASIC. Amplification coefficient deltaG has correctly the change inclination which increases so exponentially that amendment basic signal EBASIC becomes large. An example of the concrete value of amplification coefficient deltaG is time deltaG=1.0 of time deltaG=0.333 of EBASIC=0.5, time deltaG=0.667 of EBASIC=0.75, and EBASIC=1.0, as shown in drawing 4 (b). Since edge addition signal E in the gestalt of this enforcement is given by "E=EBASICxdeltaG", each of the three above-mentioned examples is set to E= 0.5x0.333, E= 0.75x0.667, and E= 1.0x1.0. That is, rectified luminance-signal Yedg at the time of EBASIC=0.5 is set to "Yedg=Y+0.5x0.333**Y+0.167", rectified luminance-signal Yedg at the time of EBASIC=0.75 is set to "Yedg=Y+0.75x0.667**Y+0.5", and rectified luminance-signal Yedg at the time of EBASIC=1.0 is set to "Yedg=Y+1.0x1.0=Y+1.0."

[0031] If this is contrasted with the example (Yedg=Y+0.25, Yedg=Y+0.5, Yedg=Y+0.75) of calculation of rectified luminance-signal Yedg of the aforementioned conventional example The value of amendment basic signal EBASIC first, a parvus case (EBASIC=0.5) To "Yedg=Y+0.25" of the conventional example, since the gestalt of this enforcement is "Yedg**Y+0.167", the degree of an edge highlight can be weakening only both difference (about "0.25-0.167=0.083"). Next, the highlight of the strength for which both do not have a difference and the value of amendment basic signal EBASIC is needed by the parvus case (EBASIC=0.75) to "Yedg=Y+0.5" of the conventional example in the middle at a degree since the gestalt of this enforcement is also "Yedg**Y+0.5" is performed. Finally, to "Yedg=Y+0.75" of the conventional example, when the value of amendment basic signal EBASIC is large (EBASIC=1.0), since the gestalt of this enforcement is "Yedg=Y+1.0", the degree of an edge highlight is strengthened only for both difference (about "1-0.75=0.25").

[0032] Therefore, with the gestalt of this enforcement, since it was made to change amplification coefficient deltaG according to the size of amendment basic signal EBASIC, the electronic still camera "which can rectify the edge various type from the edge with ******** to a quiet edge in adaptation" and which was made like and solved the 1st technical probrem [illegible] this invention can be offered..

[0033] In addition, with the gestalt of the above-mentioned enforcement, although change of amplification coefficient deltaG is made into the alignment-thing (refer to ultimate-lines 61a of drawing 4 (a), and 61b), it is not limited to this. For example, as it is made to increase from the intersection of the axis of ordinate and quadrature axis of drawing 4 (a) with a predetermined inclination, and it may be made to perform a coring after that or it is shown in drawing 5 (a), it is good also as a straight line with some folding points. In drawing 5 (a), the ultimate lines showing the relation between amendment basic signal EBASIC and amplification coefficient deltaG In the case of this example, 1st bay 63a (equivalent to "the field of a small value" given in the summary of invention), It consists of 3 bay 63c. the [2nd bay 63b (equivalent to "the field of a big value" given in the summary of invention), and] -- 1st bay 63a takes charge of the minute value field of amendment basic signal EBASIC, 2nd bay 63b takes charge of the mean-value field of amendment basic signal EBASIC, and 3rd bay 63c takes charge of the maximum (limit) field of amendment basic signal EBASIC.

[0034] These three slopes of a line have steepest 2nd bay 63b, and, as for 3rd bay [next] 63c, 1st bay 63a serves as the minimum (zero) at it so that it may be understood also from drawing. its attention should be directed -- it is the difference in the inclination of 1st bay 63a and 2nd bay 63b By this difference, while amplification coefficient deltaG small in the minute value field of amendment basic signal EBASIC can be obtained Comparatively (comparing with a minute value field) big amplification coefficient deltaG in the mean-value field of amendment basic signal EBASIC can be obtained. Consequently, it is because the electronic still camera "which can rectify the edge various type from the edge with ******** to a quiet edge in adaptation" and which was made like and solved the 1st technical probrem of this invention can be offered.

[0035] In addition, the number of the straight lines which constitute a ultimate lines is not restricted to three (1st bay 63a - 3rd bay 63c) like instantiation. You may be two and may be three or more. What is necessary is in short, just to have the ultimate-lines structure where big amplification coefficient deltaG is obtained so that amendment basic signal EBASIC becomes large. Moreover, although the inclination of 3rd bay 63c was made into the zero drawing, this is a practical device for preventing an excessive edge highlight. When the size of amendment basic signal EBASIC exceeds 2nd bay 63b, the size of amplification coefficient deltaG can be restricted to a predetermined value, and an excessive edge highlight (fault amendment) can be prevented.

[0036] Moreover, although amendment basic signal EBASIC taken out from the edge-filter section 53 was inputted into the gain-adjustment section 55 as it was with the gestalt of the above-mentioned implementation, you may prepare the coring section not only for for example, this configuration but noise suppression. Drawing 5 (b) is the example of a configuration, and the coring section 66 prepared between the edge-filter section 53 and the gain-adjustment section 55 carries out work equivalent to the coring section 13 in the above-mentioned conventional example. Namely, the coring section 66 of illustration limits amendment basic signal EBASIC of under threshold to "0", and gives it as CEBASIC=0 to the gain-adjustment section 55 while it sets to coring finishing amendment basic signal CEBASIC amendment basic signal EBASIC more than the threshold defined beforehand and gives it to the gain-adjustment section 55. Since the same effect has been acquired by setting the value of SL as "0.25" also in the gestalt of the above-mentioned implementation, the same effect as the gestalt of the above-mentioned implementation can be acquired also by the configuration which forms such coring section 66 and sets the value of SL as "0."

[0037] Next, the gestalt of enforcement of the others which enabled it to attain the 2nd technical probrem (for it to enable it to rectify the edge various type from the edge with ******** to a quiet edge in adaptation moreover, without highlighting an isolated-point noise) of this invention is explained. Drawing 6 (a) is the important section block diagram, and is the deformation block diagram of the picture image amendment processing section 57 of the gestalt of the aforementioned implementation. In drawing, the same sign is given to the gestalt of the aforementioned implementation, and the common component. The gain-adjustment section 55 outputs edge addition signal E with the value equivalent to the product of amendment basic signal EBASIC from the edge-filter section 53, and amplification coefficient deltaG' from the flatness evaluation VCF section 67 (equivalent to "an nxn piece pixel flat surface" and an evaluation means given in the summary of invention). The flatness evaluation VCF section 67 is the VCF of 3x3 configuration which is shown in drawing 6 (b), and the coefficient of "1/4" and other circumference pixels (pixel of four corners) of the coefficient whose coefficients of the central pixel (attention pixel) of a VCF are "0" and four pixels of the four directions with large influence of as opposed to an attention pixel among circumference pixels is "-1/4." The addition result of all coefficients is set to "0" by the relation of these coefficients as the beginning explained it (or it becomes a zero infinite closely).

[0038] It verifies that an isolated-point noise is suppressed with such a configuration. Drawing 7 and drawing 8 are the explanatory drawing. First, in drawing 7 , the example of a pixel distribution shown in a left end is a usual edge fraction (this example lengthwise edge fraction). The meant edge highlight must be able to be performed to such a pixel array. If it carries out as illustration of the coefficient of the edge-filter section 53, the product between each element in the edge-filter section 53 About the pixel (each pixel of a top, a upper right, the right, a lower right, the bottom, and a center) of the level 1 of the example of a pixel distribution respectively, it is set to "1x (-2/12)", "1x (-1/12)", "1x (-2/12)", "1x (-1/12)", "1x (-2/12)", and "1x1", and amendment basic signal

EBASIC which it is as a result of [these] an addition is set to "0.333." On the other hand, the product between each element in the flatness eva[illegible]ion VCF section 67 About the pixel (each [illegible] of a top, a upper right, the right, a lower right, the bottom, [illegible] a center) of the level 1 of the example of a [illegible]el distribution respectively, it is set to "1x (1/4)", "1x (-1/4)", "1x (1/4)", "1x (-1/4)", "1x (1/4)", and "1x0", and amplification coefficient deltaG' which it is as a result of [these] an addition is set to "0.25." Therefore, the output (edge addition signal E) of the gain-adjustment section 55 in this case can perform the edge highlight amendment equivalent to a part for this addition convenient, as a result of are set to "0.083" and applying this value "0.083" to luminance-signal Y in the edge adder unit 56 (refer to drawing 2).

[0039] Next, in drawing 8 , the example of a pixel distribution shown in a left end contains the isolated-point noise (that in which only an attention pixel has level greatly different from the periphery). The pixel array containing an isolated-point noise is a non-edge fraction, and must not perform an edge highlight to such a pixel array. It is because an isolated-point noise is emphasized needless to say and quality of image is degraded on the contrary. If it is in the above-mentioned conventional example, this cure is insufficient, and there was a trouble in respect of a quality-of-image degradation. If it carries out as illustration of the coefficient of the edge-filter section 53 (the same as that of drawing 7), the product between each element in the edge-filter section 53 will be set to "1x1" about the pixel (central pixel) of the level 1 of the example of a pixel distribution, and amendment basic signal EBASIC will be set to "1.0." On the other hand, the product between each element in the flatness evaluation VCF section 67 is set to "1x0" about the pixel (central pixel) of the level 1 of the example of a pixel distribution, and amplification coefficient deltaG' is also set to "0." Therefore, since the output (edge addition signal E) of the gain-adjustment section 55 in this case is rectified [luminance-signal Y=] luminance-signal Yedg even if it is set to "0" and it applies this value "0" to luminance-signal Y in the edge adder unit 56 (refer to drawing 2), it cannot perform an unnecessary edge highlight amendment, but can solve the highlight problem of an isolated-point noise.

[0040] Although the main functions of the gestalt of this enforcement are realized by the color process circuit 35 in hard above as the explanation, the thought of this invention is not limited to this implementation gestalt. That is, since it is also possible to realize functionally by organic combination with the hardware property containing a microcomputer (for example, CPU40 of drawing 1) and software property, such as OS and various programs, the implementation gestalt by such software is also included by the thought of this invention. in this case, the indispensable matter which cannot be lacked for this invention since hardware property and OS can use a general-purpose thing -- substantial -- the above -- being together put by the application programs (or driver program etc.) which mentioned main functions already can say Therefore, this invention includes the component (a unit article, a finished product, or semifinished product) containing record media or these record media, such as the floppy disk and optical disk which stored all of the programs, or the important section of the program, a compact disk, a magnetic tape, a hard disk, or semiconductor memory. In addition, what the above-mentioned record medium or a component has on a network not to mention that by which itself is in a distribution channel, and offers only the content of a record is contained.

[0041]

[Effect of the invention] When according to invention of claim 1, claim 4, claim 15, claim 11, or claim 14 publication the pixel value of the concerned edge fraction is corrected weakness, an edge highlight is performed, when the pixel value of an edge fraction is in the field of a small value, and the pixel value of an edge fraction is in the field of a big value on the other hand, the pixel value of the concerned edge fraction can be corrected strength, and an edge highlight can be performed. Therefore, the edge highlight equipment which can rectify the edge various type from the edge (the pixel value of an edge fraction is large) with ******** to a quiet edge (the pixel value of an edge fraction is the parvus) in adaptation can be offered. When the flatness of the pixel value in the nxn piece pixel flat surface containing an attention pixel is large according to invention of claim 2, claim 9, claim 12, claim 16, or claim 17 publication (for example, when it is a pixel distribution like an isolated-point noise), it can consider as a small amplification coefficient, the degree of an edge highlight is weakened, and the highlight problem of an isolated-point noise can be solved. According to invention of claim 3 or claim 13 publication, an edge fraction can be extracted by performing the operation between elements of a 2-dimensional VCF, and since an image memory etc. can constitute a 2-dimensional VCF easily, simplification of a system can be attained. According to invention of claim 5 or claim 6 publication, the edge highlight equipment which can rectify the edge various type from the edge (the pixel value of an edge fraction is large) with ******** to a quiet edge (the pixel value of an edge fraction is the parvus) in adaptation can be offered. According to invention of claim 7 or claim 10 publication, the highlight problem of an isolated-point noise is solvable. According to invention of claim 8 publication, an excessive edge highlight can be suppressed.

[Translation done.]

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[An easy explanation of a drawing]
[Drawing 1] It is the block diagram of an electronic still camera.
[Drawing 2] It is the block diagram of the color process circuit 35.
[Drawing 3] It is drawing showing the VCF conceptual diagram of the edge-filter section 53, and an example of a filter factor.
[Drawing 4] It is the correlation diagram showing the correspondence relation with the correlation diagram, and amendment basic signal EBASIC and edge addition signal E which shows the correspondence relation between amendment basic signal EBASIC and amplification coefficient deltaG.
[Drawing 5] It is drawing showing other ultimate liness (thing with a folding point) showing the relation between amendment basic signal EBASIC and amplification coefficient deltaG.
[Drawing 6] It is the important section block diagram of the gestalt of other enforcement.
[Drawing 7] It is explanatory drawing (1/2) for a suppression verification of an isolated-point noise.
[Drawing 8] It is explanatory drawing (2/2) for a suppression verification of an isolated-point noise.
[Drawing 9] They are the important section idea block diagram of the conventional electronic still camera, and the block diagram of the color processing circuit 5.
[Drawing 10] It is drawing showing the block diagram of the picture image amendment processing section 10, the first example of a pixel array, and the second example of a pixel array.
[Drawing 11] It is the input-output-behavioral-characteristics view of the coring section 13.
[An explanation of a sign]
E Edge addition signal (correction value for an edge highlight)
P0.5 Field of a small value
P 0.75, P1.0 Field of a big value
deltaG Amplification coefficient
deltaG' Amplification coefficient
53 Edge-Filter Section (2-dimensional VCF, Extraction Means)
57 Picture Image Amendment Processing Section (Edge Highlight Equipment, Gain-Adjustment Means, Change Means)
63a The 1st bay (field of a small value)
63b The 2nd bay (field of a big value)
67 Flatness Evaluation VCF Section (NXN Piece Pixel Flat Surface, Evaluation Means)

[Translation done.]

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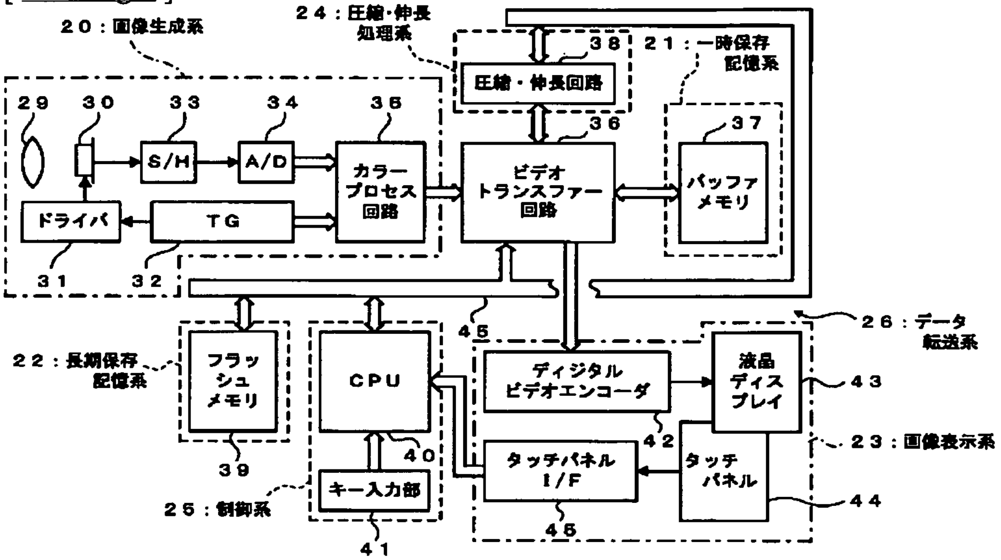
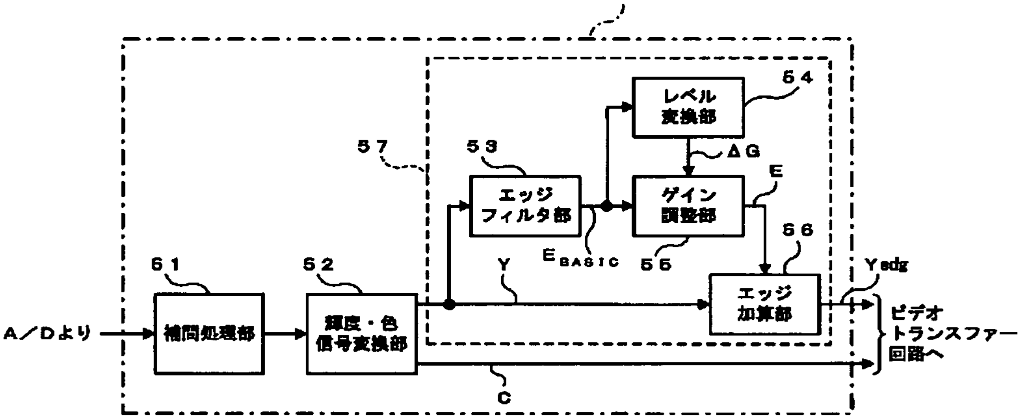
DRAWINGS

[Drawing 1]


20：画像生成系
24：圧縮・伸長処理系
38
21：一時保存記憶系
圧縮・伸長回路
29
30
33
34
35
36
37
S/H
A/D
カラープロセス回路
ビデオトランスファー回路
バッファメモリ
ドライバ
TG
31
32
45
26：データ転送系
22：長期保存記憶系
フラッシュメモリ
CPU
ディジタルビデオエンコーダ
液晶ディスプレイ
43
42
23：画像表示系
39
40
タッチパネルI/F
タッチパネル
44
25：制御系
キー入力部
46
41

[Drawing 2]


35
54
レベル変換部
57
53
ΔG
E
エッジフィルタ部
ゲイン調整部
56
51
52
Y
E_BASIC
55
Yedg
A／Dより
補間処理部
輝度・色信号変換部
エッジ加算部
ビデオトランスファー回路へ
C

[Drawing 3]

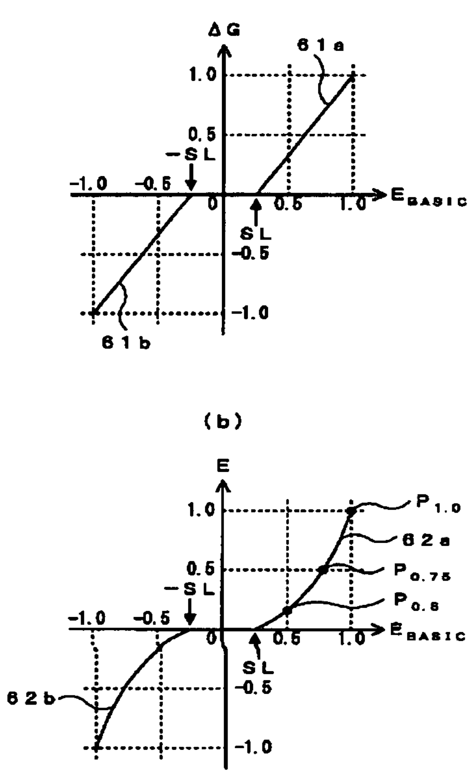
(a)

K_{NW}	K_N	K_{NE}
K_W	K_C	K_E
K_{SW}	K_S	K_{SE}

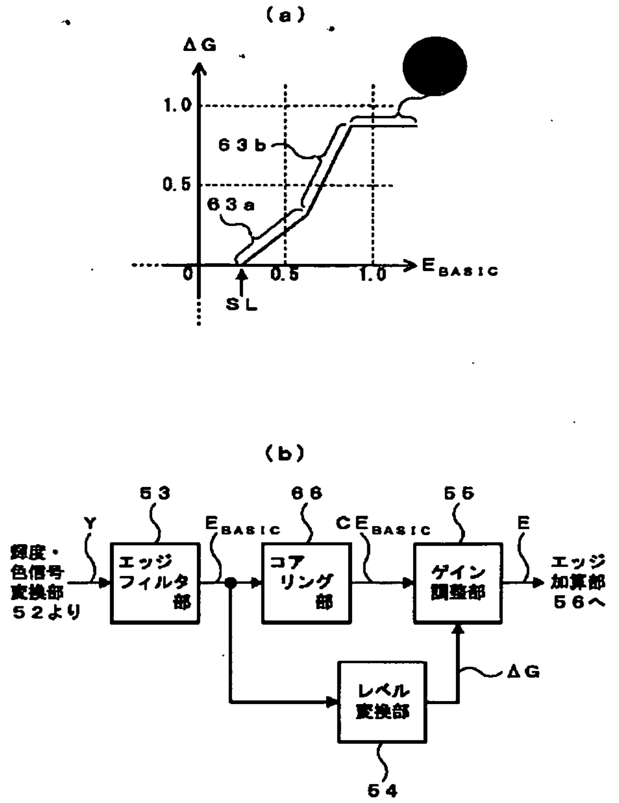
(b)

$-\frac{1}{12}$	$-\frac{2}{12}$	$-\frac{1}{12}$
$-\frac{2}{12}$	1	$-\frac{2}{12}$
$-\frac{1}{12}$	$-\frac{2}{12}$	$-\frac{1}{22}$

[Drawing 4]

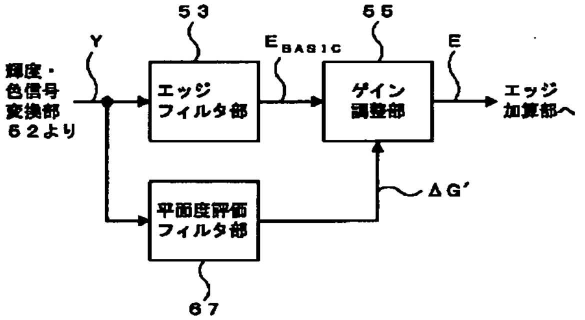


[Drawing 5]


(a)
ΔG
1.0
0.5
63b
63a
0
0.5
1.0
E_BASIC
SL
(b)
53
66
55
Y
E_BASIC
CE_BASIC
E
輝度・色信号変換部52より
エッジフィルタ部
コアリング部
ゲイン調整部
エッジ加算部56へ
レベル変換部
ΔG
54

[Drawing 6]

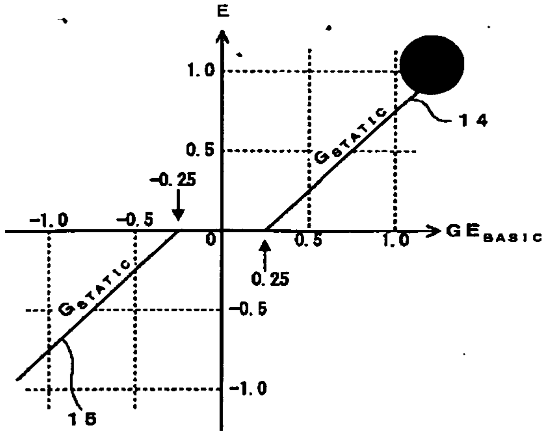
(a)


53
55
Y
E_BASIC
E
輝度・色信号変換部62より
エッジフィルタ部
ゲイン調整部
エッジ加算部へ
平面度評価フィルタ部
ΔG'
67

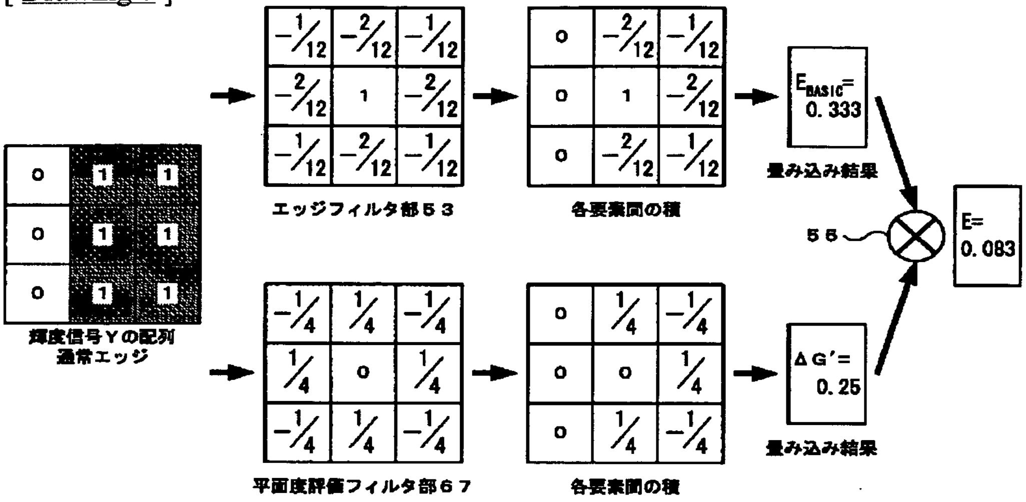
(b)

$-1/4$	$1/4$	$-1/4$
$1/4$	0	$1/4$
$-1/4$	$1/4$	$-1/4$

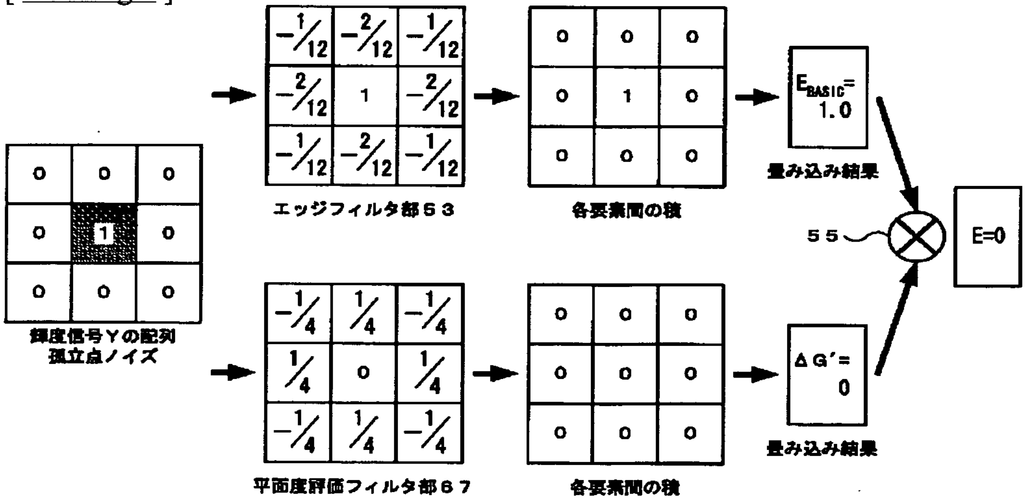
[Drawing 11]



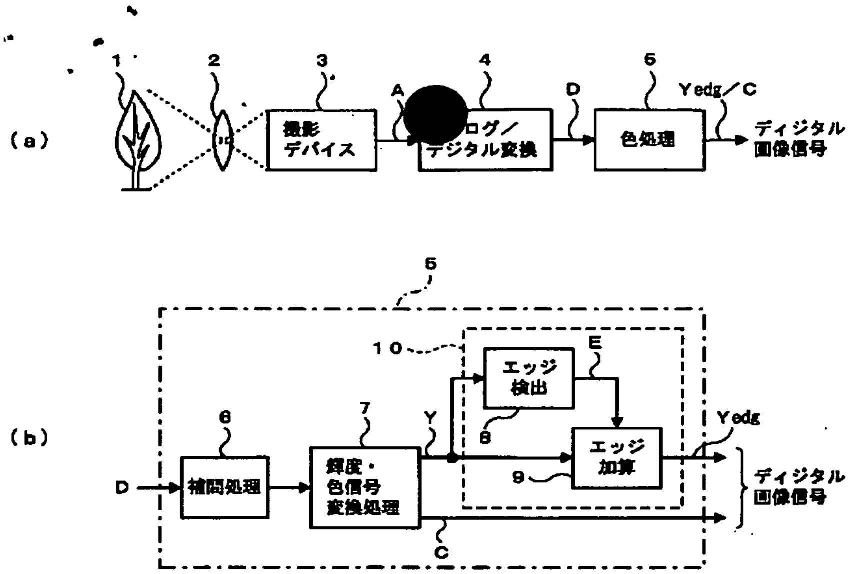
[Drawing 7]


0 1 1
0 1 1
0 1 1
輝度信号Yの配列
通常エッジ
-1/12 -2/12 -1/12
-2/12 1 -2/12
-1/12 -2/12 -1/12
エッジフィルタ部53
0 -2/12 -1/12
0 1 -2/12
0 -2/12 -1/12
各要素間の積
E_BASIC= 0.333
畳み込み結果
55
E= 0.083
-1/4 1/4 -1/4
1/4 0 1/4
-1/4 1/4 -1/4
平面度評価フィルタ部67
0 1/4 -1/4
0 0 1/4
0 1/4 -1/4
各要素間の積
ΔG'= 0.25
畳み込み結果

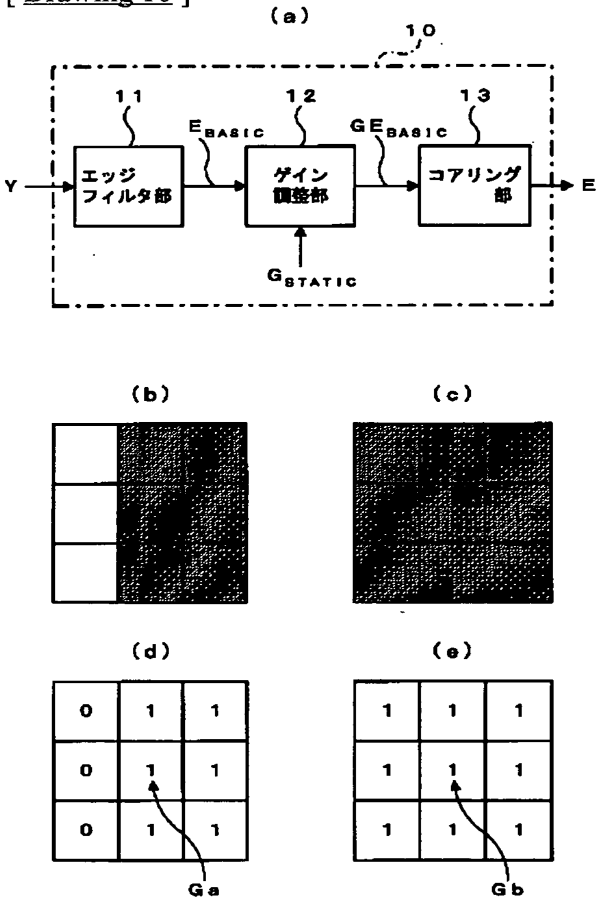
[Drawing 8]


0 0 0
0 1 0
0 0 0
輝度信号Yの配列
孤立点ノイズ
-1/12 -2/12 -1/12
-2/12 1 -2/12
-1/12 -2/12 -1/12
エッジフィルタ部53
0 0 0
0 1 0
0 0 0
各要素間の積
E_BASIC= 1.0
畳み込み結果
55
E=0
-1/4 1/4 -1/4
1/4 0 1/4
-1/4 1/4 -1/4
平面度評価フィルタ部67
0 0 0
0 0 0
0 0 0
各要素間の積
ΔG'= 0
畳み込み結果

[Drawing 9]


(a)
1
2
3
4
5
A
D
Yedg／C
撮影
デバイス
ログ／
デジタル変換
色処理
ディジタル
画像信号
(b)
5
10
E
エッジ
検出
8
6
7
Y
Yedg
D
補間処理
輝度・
色信号
変換処理
9
エッジ
加算
C
ディジタル
画像信号

[Drawing 10]


(a)
10
11
12
13
E_{BASIC}
GE_{BASIC}
Y
エッジ
フィルタ部
ゲイン
調整部
コアリング
部
E
G_{STATIC}
(b)
(c)
(d)
0
1
1
0
1
1
0
1
1
Ga
(e)
1
1
1
1
1
1
1
1
1
Gb

[Translation done.]